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25X1

PAR 212

5 June 1964

SUBJECT: Color Acquisition System Review Study

TASK/PROBLEM

1. Investigate color photography as a possible anticipated intelligence medium. Investigation should cover the capability of present and possible future acquisition systmes in an attempt to preduct future requirements to support exploitation and data reduction of the collected color photographic intelligence material.

DISCUSSION

2. Resolution, sensitometric data and acquisition system capabilities were considered, collected and evaluated in the following steps:

a. A review of seven films was made revising an earlier collection of similar data. (See Table I, Material Characteristics)

b. For usable density ranges, the contrast of each of the films was measured as the straight line slope or gradient (G) between densities of 1.0 and 2.0. These values for each product were then multiplied by the similar measurement for the materials which might be usable as a duplicating film.

c. By examination of these calculations and selecting only those systems where the system gradient is less than 6.2, a more condensed version of films for potential use is readily discernable. This is shown as "Most Promising Systems", Table II. This table clearly demonstrates that at the present time the best taking material is Type 5029 (Kodachrome II for Daylight) and the best duplicating materials are SO-271 (Ektachrome Duplicating Film) and Type 5029. If we assume a taking film should be on thin Estar support then only SO-121 (Ektachrome High Definition Aero Film) is available since the 6513 supply is exhausted. (The supply of 3703 is also exhausted.)

3. From the studies made of selected acquisition materials, the following conclusions were drawn:

a. The best color acquisition film available is the Ektachrome High Definition Aerial Film, Type SO-121.

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Table I: Material Characteristics

Name	Resolution 1.6:1	Resolution >10.1	Contrast* R	Contrast* G	Contrast* B	Fog R	Fog G	Fog B	Process	E.I.
Ektachrome Aero	32	100	3.1	3.4	3.1	.07	.12	.13	ME-4M	25
Experimental "High Definition" Ektachrome	59-67	107-120	2.5	3.3	3.0	.15	.25	.23	ME-4	10
"High Definition" Ektachrome Aero	76	151	2.9	3.6	2.8	.14	.16	.18	ME-4	13
Experimental "High Definition" Kodachrome	68	102	3.3	4.1	2.6	.06	.22	.24	K-12	3.5
Kodachrome II for Daylight	53-67	119	2.0	1.7	1.6	.14	.45	.35	K-12	3.5
Kodak Special Color Duplicating Film	32	71	1.7	1.8	1.7	.12	.12	.12	ME-4M	----
Experimental Kodachrome Duplicating Film	76	134	2.2	2.0	1.6	.13	.41	.32	K-12	----

measured between densities of 1.0 and 2.0.

able.

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Table II:
Calculated Maximum Average
Resolution of Most Promising Systems
(System contrast is 6.2 or less)

Original	Duplicating Materials: SO-121	SO-271	2503	*3703	*6513	5029
8442	------	36	----	----	----	47
SO-121	------	44	----	----	----	62
*3703	------	----	----	----	----	----
5029	62	41	59	----	55	56
*6513	------	41	----	----	----	55

*Not available.

b. Color aerial photography taken at altitudes of 12,000 to 16,000 feet have too high a scene luminance to simulate high altitude (above 50,000 feet). Our prime interest is best quality second generation and the duplicating of a simulated high altitude scene does not truly demonstrate the duplicating material's capabilities. Such duplicates have a degraded quality.

c. Generation of actual high altitude originals are of paramount importance to continue the studies. A meeting was held with [redacted] 25X1
25X1 [redacted] people relative to this problem. Current activity has been low temporarily because of this need.

PLANNED ACTIVITIES

4. Studies will continue with the aim of obtaining scenes that accurately represent photography at altitudes above 50,000 feet. Other technical and theoretical work will continue prior to and concurrent with the needed high altitude acquisition.

GROUP-1
Excluded from automatic downgrading
and declassification

February 20, 1964

Revised 13 May 64

2. Lenses: A survey will be made of potential lenses to determine their capability to record target data on all types of color sensors. This survey is to be carried out only to that extent necessary to obtain that information required as input for other aspects of the study. Firm conclusions must depend upon the availability of these lenses to verify theoretical data.

3. Filters: Investigation will be made for the possible use of filters to aid in the exploitation of intelligence. This investigation may be in two parts.

   (a) Possible use of filters in the collection system to enhance the data reduction capability.

   (b) Possible use of filters, on exploitation equipments to extract or add colors to the correctly exposed material, as an aid in the intelligence data reduction process.

4. Scale and Altitude: The effect of focal length, altitude, and haze upon image size vs resolution, (grain, color smear, and etc.) will be studied to determine design parameters for read-out equipments.

5. Film: Both negative and reversal type film will be compared and their capabilities including resolution, reproducibility, and suitability for intelligence data collection will be analyzed.

6. Processing: Since this study is not oriented toward equipments except those for use in read-out of the intelligence information, it will be assumed that color film will, in all cases, be processed in accordance with manufacturers' recommendations.